



UNIVERSITY OF RUHUNA

Faculty of Engineering

End -Semester 4 Examination in Engineering: December 2015

Module Number: ME4225 Module Name: Automobile Engineering (O/C)

[Three Hours]

[Answer all questions, each question carries ten marks]

- Q1. (a) Describe with the aid of neat sketches the four stroke cycle of a single cylinder Compression Ignition Engine. **[3 marks]**
- (b) State why the two stroke cycle Compression Ignition (CI) engines find wider use where-as two stroke cycle Spark Ignition (SI) engines are used only to a very limited extent. **[3 marks]**
- (c) A petrol engine uses fuel of calorific value $44,000 \frac{\text{kJ}}{\text{kg}}$ and has specific gravity of 0.74. The brake thermal efficiency and mechanical efficiency of the engine are 25% and 75% respectively. If the engine develops 50 kW of brake power, calculate;
- (i) The fuel consumption in litres per hour.
- (ii) The indicated thermal efficiency of the engine **[4 marks]**
- Q2. (a) Name three types of lubricating systems used in IC engines. List out five functions of the lubricating system. **[4 marks]**
- (b) Give five properties of lubricating oil to meet the requirements of a proper lubricating system. **[3 marks]**
- (c) Draw a sketch of a full pressure lubricating system and name the important parts of it. Also briefly explain the operation of it. **[3 marks]**
- Q3. (a) Name different methods of engine cooling systems. Explain in detail air cooling method. **[2 marks]**
- (b) Name two possible reasons why an air-cooled engine might make comparably more noise than a water-cooled engine. **[2 marks]**
- (c) With neat sketches discuss the construction and working of thermostat used in an IC engine. **[2 marks]**

Question Q3 is continued on page 2

(d) The output from a car engine is 80 kW. The brake thermal efficiency of the engine is 25% and heat lost to the coolant is 30% of the heat supplied by the combustion of fuel. If the specific heat of water C_p is 4.13 kJ/kg.K;

(i) How much heat dissipated from the radiator of the car to the atmosphere?

(ii) Estimate the quantity of water to be circulated for proper engine cooling if the engine coolant (water) is to be cooled in the radiator from 353 K to 303 K.

[4 marks]

Q4. (a) What is the function of a carburetor in an SI engine? Briefly explain with a neat sketch the operation of a simple float type carburetor.

[2 marks]

(b) Name five additional systems which are added to the simple carburetor to satisfy the fuel demands of an engine under all running conditions and explain the operation of each additional system.

[5 marks]

(c) A spark ignition engine has a fuel-air ratio of 0.07:1. How many kilograms of air per hour are required for an output of 75 kW at an overall thermal efficiency of 20%. How many cubic meters (m^3) of air are required per hour if the density of air is 1.2 kg/ m^3 ?

If the fuel vapour has a density four times that of air, how many cubic meters (m^3) per hour of the mixture required? The calorific value of the fuel is 43,000 kJ/kg.

[3 marks]

Q5. (a) Describe the two types of diesel injection systems in CI engines. Why is the air injection system not used nowadays?

[3 marks]

(b) Discuss the requirement of an ideal diesel injection system of a CI engine.

[3 marks]

(c) It is assumed that an automobile engine can operate at a thermal efficiency of 22 % when operating conditions are as follows:

Volumetric efficiency of 80%; mechanical efficiency of 82%; heat value of petrol 46000 kJ/kg; theoretical air required per kg of petrol is 14.5; excess of air 25%; petrol vapour has density twice the density of air and the mixture at the end of suction stroke is at a pressure of 8.24×10^4 N/ m^2 and a temperature of 333 K. Gas constant for air is 287.14 J / kg.K.

Find the cylinder dimensions (stroke and the cylinder diameter) of a six-cylinder engine at the above conditions when the engine develops its rated power of 66 kW at a speed of 4200 rpm. Assume the stroke is 25% greater than the diameter

[4 marks]